RESPONSE

Remarks

Claims 1, 3 - 6 and 8 have been amended. New claim 31 has been added. Claims 1 - 9 and 29 - 31 are pending.

Examination and reconsideration of the application as amended is requested.

Support for new claim 31 can be found in the specification, for example, on page 6, lines 9 - 22.

Objections to the Drawings

The Office action raised objection to Figure 1 of the present invention. Individual aspects of Figure 1 will be addressed, in the following section, giving explanation to overcome the objections.

The drawings are objected to because it is unclear what Character 50 is inclusive of. It appears that 50 is representative of either just a bias tee, or the elements disposed along the horizontal axis of the drawing. It is disclosed that item 50 is a signal source. An enclosure of some sort, such as a dashed box, should surround the elements included in item 50.

As suggested, a box now encloses the signal source **50** that includes DBR laser held above its lasing threshold using a DC power supply **16.** I_{DC} uses I as the conventional symbol representing electrical current, identifying it as direct current using the subscript DC. The signal source **50** uses a bias tee **14** that combines inputs of modulation current (frequency synthesizer **12**) and bias current to control the DBR laser so that the laser output is frequency modulated (see description in the present application at page 5, lines 8 - 18).

A similar objection is made for item 100. An enclosure surrounding the pulse train generator should be made.

A dotted-line box has been added to Figure 1 to clarify the pulse train generator.

Also, item 10 is objected to for being disclosed as a two-part element, but is shown as a single piece connected to a multiplicity of parts. The incorporation by reference of the signal source's parts and operation is not adequate for a proper understanding of the invention, especially in light of the above objections with respect to the boundaries of elements. Items 10 and 50 are further objected to as having both been disclosed as a signal source. Both characters cannot be the signal source, especially in light of the above objections. If one item is a smaller part of another element, a separate title for the item must be given, and the parts included in the other must be clearly shown.

It can be shown that description in the present invention of a "2 section InGaAsP distributed Bragg reflector (DBR) laser" has its origin in the reference of Kjebon et al. Under the

heading "Fabrication and Measurements:" Kjebon et al describes a DBR laser unit that includes an active section and a passive section. Figure 1 of the reference depicts a schematic diagram of a DBR laser. It is appropriate to represent such a scheme as a single part.

A distributed Bragg reflector laser (DBR) **10** is a signal source. The signal source **50** of the present invention includes the DBR **10** producing a frequency modulated output signal under the control of the bias tee **14**, as described on page 5, lines 8 - 18. The need for separate labeling has been met using numeral **10** to identify the (DBR) as the lasing unit of the signal source **50**.

Item 12 is objected to as being shown applied to the bias tee, despite its description in the specification as being applied to the mirror section of the DBR.

The present application on page 4, line 24 states, "A frequency synthesizer **12** inputs into a bias tee **14**. At page 5, lines 11 - 13, the description includes, "- - current signal supplied by the frequency synthesizer **12** - - was applied to the mirror section of the DBR." This combination of statements shows that the frequency synthesizer **12** applies the current to the bias tee **14**, which then controls the mirror section of the DBR laser.

OSA is shown as item 80, but disclosed as item 9 (in line 26, page 5).

A replacement paragraph accompanies this response for correction of the typographical error identifying the OSA by numeral **9**.

The drawings are objected to as failing to comply with 37 CFR §1.84(p)(5) because they include the following reference sign(s) not mentioned in the description. I_DC. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Page 5, line 8 of the present invention identifies a power supply **16** as a source of direct current. The symbol "I_{DC}" is well known as an abbreviation for direct current. Alternate use of description or abbreviation should be well understood by one of ordinary skill in the art.

The drawings are objected to as failing to comply with 37 CFR §1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: GVD; a mirror in a DBR; the application of item 12 to a mirror of a DBR; a graded index lens, isolator 7; coupler/splitter and its relationship to item 20; and a spatially chirped Bragg grating connected to a circulator to cause compression of the signal. A proposed drawing correction or corrected drawings are required in response to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

The term GVD appears a number of times in the description of the present application. It refers to the Group Velocity Dispersion of the chirped grating (Page 6, line 17) that refers to the "spatially chirped - - fiber optic Bragg grating (FBG)" identified by numeral **30** earlier described at line 11 of page 6.

Reference to "a mirror in a DBR" in the Office Action describes the section within the DBR **10** laser unit that is affected by the signal from the bias tee **14** to cause frequency modulation of the laser output.

Application of item 12 has been explained previously.

Identifying labels have been added to conform the diagram of Figure 1 to the description of "a graded index lens 8, a pigtailed optical isolator 7" and a "coupler/splitter" to show their relationship to item 20. The description is found from page 5, line 26 to page 6, line 16.

The spatially chirped Bragg grating is the dispersive element **30** as described on page 6, lines 9 - 22.

The drawings are objected to under 37 CFR §1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, a dispersive element used to cause compression of the signal in time, the relationship of the dispersive element to a clear and correct representation of a frequency modified laser; and a laser equipped with a reflective element and its interaction with a current source must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

The dispersive element is identified in the drawing by numeral **30**. Its relationship to the laser is shown by the signal path, starting with the output from the DBR laser **10**, which passes via the GRIN **8**, the optical isolator **7**, the optic coupler splitter and the circulator **20**, to the fiber Bragg grating (dispersive element) **30**.

The construction of a DBR laser unit **10**, containing a mirror section, has been addressed previously. One of ordinary skill in the art will recognize that the diagram of Figure 1 provides the components needed for frequency modulation of the laser output. As indicated above, the bias tee, not the frequency synthesizer, provides the input for frequency modulation of the DBR laser.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Acceptance is requested for the new Figure 1 submitted herewith.

Claims Objections

Claim 8 is objected to because of the following informalities: "the mirror" is referred to in the last line of the claim, yet only a reflective element has been previously introduced. There is insufficient antecedent for the limitation in the claim. For examination purposes, Examiner assumes "the reflective element" was intended. Appropriate correction is required.

Claim 8 has been amended to overcome objection by reciting "the reflective element" instead of "the mirror" in the last line of the claim.

Rejections under 35 U.S.C. §112

Claims 4 - 6 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The rejection was stated in the Office Action, as follows:

Claims 4 - 6 recited the limitations "wherein the fiber has a length of at least about 40km" in line 1; "wherein the fiber has a length of at least about 60km" in line 1; and "wherein the fiber has a length of at least about 80km" in line 1. There is insufficient antecedent basis for these limitations in the claims.

Claim 3 has been amended to introduce "a length of a single mode fiber." Amendment of claims 4 - 6 makes reference to "said length" to overcome rejection of claims 4 - 6 under 35 U.S.C. §112, second paragraph. Withdrawal of the rejection is requested.

Rejections under 35 U.S.C. §103(a)

Comparison of Teachings of the References and the Present Invention

Heritage et al (U.S. 4,928,316) teaches a process for shaping picosecond to femtosecond pulses by means of phase and/or amplitude modulation to form the desired shaped pulses, which contain information or data to be conveyed (Column 4, lines 44 - 51). The process may be applied to "any source of ultrashort pulses" (Column 5, lines 44 - 45), of which Heritage et al exemplifies "a mode locked laser or a fiber and grating pulse compressor" (Column 5, lines 41 - 42). No evidence identifying a particular source of pulses appears in the reference.

Kjebon et al describes a design for a semiconductor laser, described as a DBR (distributed Bragg reflector) laser. In DBR lasers, "the dispersive effect of the Bragg grating, detuned loading, can alter both the frequency of the resonance peak and its damping" (see last sentence of the Introduction). Kjebon et al teaches the fabrication of a laser using detuned loading. Damping of the laser counteracts self-pulsation leading to a high bandwidth laser

output. This suggests the need to prevent pulsation effects to obtain the high bandwidth laser of Kjebon et al.

The present invention teaches the use of a "tunable DBR" high bandwidth laser of the type described by Kjebon et al (see page 4, lines 1 - 20). A laser of this type becomes frequency modulated using frequencies lower than, but not synchronous with, the laser cavity resonance. Output from the frequency modulated laser passes through a long chirped fiber Bragg grating (FBG) that has a large group velocity dispersion. Large group velocity dispersion selectively compresses the up-chirped portion of the signal into a series or train of pulses containing approximately 40% of the initial energy (page 3, lines 11 - 21). Accordingly, the present invention provides a source of picosecond pulses that could be shaped using the method of Heritage et al. A pulse source according to the present invention offers improvement over systems based upon mode locking and gain switching.

This response continues with a brief comparison between the references and claims of the present invention that were rejected for obviousness over the references.

Limitations of Claim 1 of the Invention	Taught or suggested by Heritage (U.S. 4,928,316) or Kjebon
"a frequency modulated signal" The present invention applies frequency modulation to the high bandwidth output of a DBR semiconductor laser. A dispersive element converts the frequency modulated signal to a pulse train	No The Office Action admits that Heritage et al fails to teach the use of a frequency modulated signal. Heritage et al starts with a "source of ultra-short pulses" of indeterminate origin. Kjebon describes a frequency modulated signal but is as silent as Heritage et al concerning a method for generating signal pulses.
"said dispersion element being adapted to compress the signal in time" Pulse development from a frequency modulated signal occurs using a single grating element	No Heritage et al discusses compression of shaped signals but teaches the requirement for multiple gratings and lens +gratings combinations for this purpose (Fig. 3).

<u>Claim 1</u>

The Office action addressed claim 1 of the present application as follows:

> Claims 1 - 9 and 29 - 30 are rejected under 35 U.S.C. §103(a) as being unpatentable over Heritage et al (U.S. 4,928,316) in view of Kjebon.

Portions of the rejection will be addressed as separate statements with comments to show that the present invention is not obvious over the references either separately or in combination.

Statement

Regarding claim 1, Heritage teaches a method for generating a pulse train, comprising the steps of providing a signal (Column 5, lines 40 - 45), and impinging the signal on a dispersive element (Column 5, lines 45 - 63), said dispersive element being adapted to compress the signal in time (Column 5, lines 59 - 63).

Comment

Applicants submit that, contrary to the statement above, the reference of Heritage et al does not teach "generating a pulse train," but instead describes the application of a pulse-shaping method to a signal emanating from a source of picosecond or femtosecond pulses. Unlike the present invention, the reference gives no details of generation of ultra-short pulses that were subsequently shaped according to the method of Heritage et al. The reference describes dispersive elements that stretch and thereafter compress signal pulses, as required for pulse shaping.

Statement

Heritage does not specifically teach the use of a frequency modulated signal. He instead teaches that any suitable source of a signal is useable in the dispersive system taught (Column 5, lines 40 - 45).

Comment

The admission by the Office Action that Heritage et al fails to specifically teach the use of a frequency modulated signal represents proof that the present invention is not obvious over this reference. Generation of a pulse train according to the present invention requires the "frequency modulated signal" recited in Claim 1. The resulting pulse train could be subjected, as "any suitable source," to the pulse shaping method of Heritage et al. This does not change the fact that Heritage et al is silent regarding a method for generating a pulse train using "a dispersive element (being) adapted to compress" a frequency modulated signal in time.

Statement

Kjebon teaches a laser source with an integral dispersive element (Fig. 1). The device of Kjebon is used for the purpose of creating a signal of 30 GHz on a laser, which according to the article by Kjebon is a record high signal with increased resonance frequency and reduced damping.

Comment

Application of the reference of Kjebon et al only provides a description of the design of a semiconductor DBR laser that suppresses self-pulsation using resonance peak damping. Production of a high bandwidth signal, based upon the teachings of Kjebon et al, relies upon a laser output that is substantially pulse free.

Heritage et al does not teach generation of a pulse train. Kjebon suggests that signal pulsation represents a barrier to a high bandwidth laser output. In effect, while the reference of Heritage et al teaches nothing about pulse train generation, the reference of Kjebon teaches away from a pulsed signal source. These facts provide evidence that the present invention is allowable since the requirements of rejection for obviousness under 35 U.S.C. §103(a) cannot be met by these references.

Specifically, the references do not present teachings relevant to the present invention. There is mention of the difference between the present invention and that of Heritage et al. This takes the form of what is missing (frequency modulated signal). The third basis of rejection for obviousness, i.e. proposed modification of the applied reference(s) necessary to arrive at the claimed subject matter, is absent from the references, which do not teach "a method for generating a pulse train," as recited in the preamble of claim 1. If there is no proposed modification of the applied reference(s) to arrive at the claimed subject matter, it is unlikely that one of ordinary skill in the art at the time the invention was made would have knowledge, allowing modification of the references to provide the method of generating a pulse train according to the present invention.

Conditions for rejection of the present invention under 35 U.S.C. §103(a) have not been met because the indicated claims limitations are neither taught nor suggested by the references, as required for rejection of the invention for obviousness. Rejection of claim 1 under 35 U.S.C. § 103(a) as being unpatentable over Heritage et al in view of Kjebon et al has been overcome and should be withdrawn.

The Office Action explains rejection of claims depending from claim 1 of the present invention in a series of statements presented below with comments indicating errors of rejection.

Statement

Regarding Claims 2 - 3, Heritage teaches the method of claim 1 wherein the dispersive element is a fiber Bragg grating and further teaches the element is a single mode fiber (Column 7, lines 44 - 65).

Comment

Not only does Heritage et al not teach "generating a pulse train," as discussed previously, but the description of Figure 3 of the reference indicates a dispersive system more complex than the fiber Bragg grating of the present invention.

Statement

Regarding claims 4 - 6, Heritage teaches that the fiber length of the dispersive system increases under certain circumstances (Column 3, lines 28 - 62, especially Column 7, lines 10 - 13 and Column 4 lines 43 - 45 of Patent U.S. 4,746,193 cited by Heritage). The increase in length of the dispersive element is understood to include lengths of at least 40, 60 and 80 km.

Comment

United States Patent U.S. 4,746,193, to Heritage et al, cited in U.S. 4,928,316 relies, upon modification of input pulses from an indeterminate pulse source. This is the same situation as discussed above showing that the methods of Heritage et al depend upon an input that consists of a series of pulses. This differs from the present invention, which uses, in the embodiments of claims 4 - 6, a dispersive element in the form of a single mode optical fiber to provide a pulse train using a frequency modulated DBR laser signal as the input signal.

Statement

Regarding claim 7, Kjebon teaches a signal having a single longitudinal mode (Page 488 - 489).

Comment

Kjebon does not teach the frequency modulated signal of claim 1. Claim 7 depends from claim 1 to add the limitation that the frequency modulated "signal has a single longitudinal mode."

Statement

Regarding claim 8, Kjebon teaches a signal generated by a laser equipped with a reflective element, and wherein the signal is frequency modulated by applying a current across the reflective element (Page 488 - 489).

Regarding claim 9, Kjebon teaches a range of wavelengths, understood to include the center wavelength of the reflective element, for the laser, wherein the current modulates the center wavelength by way of carrier induced index changes (Pages 488 - 489).

Comment

Rejections of Claims 8 and 9 do not consider other limitations associated with their dependency from claim1. Previous discussion confirms that the references of Heritage et al and Kjebon et al are ineffective as a basis for rejection of the present invention for obviousness.

Claims 2 -9 each add additional limitations to claim 1. Claim 1 is patentable for the reasons given above. Thus, claims 2 - 9 should likewise be patentable.

Statement

Regarding claim 29, Heritage teaches a method for producing a pulse train, comprising the steps of providing a signal (Column 5, lines 40 - 45); providing a dispersive element; and directing the signal into the dispersive element (Column 5, lines 45 - 63), wherein the dispersive element is a long fiber Bragg grating (Columns 3, 5 and 7 teach the use of many art recognized grating schemas through reference, understood to include long fiber Bragg gratings).

Heritage does not specifically teach the use of a frequency modulated laser for providing a frequency modified optical signal. He instead teaches that any suitable source of a signal is useable in the dispersive system taught (Column 5, lines 40 - 45).

Kjebon teaches a laser source with an integral dispersive element (Fig. 1). The device of Kjebon is used for the purpose of creating a signal of 30 GHz on a laser, which according to the article of Kjebon is a record high signal with increased resonance frequency and reduced damping.

Regarding Claim 30, Kjebon teaches a single mode signal source (Pages 488 - 489).

Comment

Admission by the Office Action that Heritage et al "does not specifically teach the use of a frequency modulated laser for providing a frequency modified optical signal" is acknowledgement that the reference does not teach or suggest all of the limitations of the present invention, as required for rejection of an invention for obviousness. Also, as stated with regard to claim 1, Heritage et al require a pulsed input signal generated by a source of ultra-short pulses, but is silent concerning a method for "producing a pulse train" according to claim 29 of the present invention.

Conditions for rejection of the present invention under 35 U.S.C. §103(a) have not been met because the indicated claims limitations are neither taught nor suggested by the references, as required for rejection of the invention for obviousness. Rejection of claim 29 under 35 U.S.C. § 103(a) as being unpatentable over Heritage et al in view of Kjebon et al has been overcome and should be withdrawn.

Claim 30 adds an additional limitation to claim 29. Claim 29 is patentable for the reasons given above. Thus, claim 30 should likewise be patentable.

In summary, the rejection of claims 1 - 9 and 29 -30 under 35 U.S.C. § 103 as being unpatentable over Heritage et al in view of Kjebon et al has been overcome and should be withdrawn.

Applicant has made an earnest attempt to respond to each point made by the Examiner. Based on the foregoing reasons, it is submitted that the application is in condition for allowance. Request is respectfully made for reconsideration of the application and allowance of amended claim 1, 3 - 6 and 8 as well as original claims 2, 7, 9, 29 and 30 and new claim 31.

Please charge Deposit Account 13-3723 any amounts due and owing by reason of this response. For further questions, please contact Applicant's agent who may be reached at telephone number (512) 984-5258.

Registration Number	Telephone Number
42,286	(512) 984-5258
Date March 25, 2003	

Respectfully submitted,

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Version With Markings to Show Changes Made

The constant amplitude, frequency modulated output of the DBR laser was focused by means of a graded index (GRIN) lens into a fiber pigtailed optical isolator 7 (available as model number I-15-PIPT-MU-A from isowave, Inc., Dover, NJ) which prevented backreflections from destabilizing the laser. To monitor the output of the laser, a portion of the light exiting the isolator was split off by focussing the light into one input of a 1550 nm 95/5 single mode fiber optic coupler/splitter (Gould Fiber Optics, Millersville, MD). The 5% output of the splitter was directed into an optical spectrum analyzer (OSA) [9] 80 (available as model number HP 70950B from Hewlett Packard, Inc., Palo Alto, CA).

1. (amended) A method for generating a pulse train, comprising the steps of:
providing a frequency modulated signal; and
impinging the signal on a dispersive element, said dispersive element being adapted to compress the signal in time to produce said pulse train.

3. (amended) The method of claim 1, wherein said [the] dispersive element is a length of a single mode fiber.

4. (amended) The method of claim 3, wherein said [the fiber has a] length [of] is at least about 40km.

5. (amended) The method of claim 3, wherein said [the fiber has a] length [of] is at least about 60km.

6. (amended) The method of claim 3, wherein said [the fiber has a] length [of] is at least about 80km.

8. (amended) The method of claim 1, wherein the signal is generated by a laser equipped with a reflective element, and wherein the signal is frequency modulated by applying a current across the [mirror] <u>reflective element</u>.